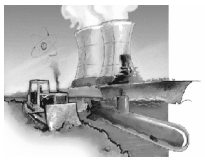
Novel Silica-Based Ion-Exchange Resin



Developer: Eichrom Industry
Contract Number: DE-AR21-96MC33088
Crosscutting Area: ESP

Mixed Waste FOCUS AREA

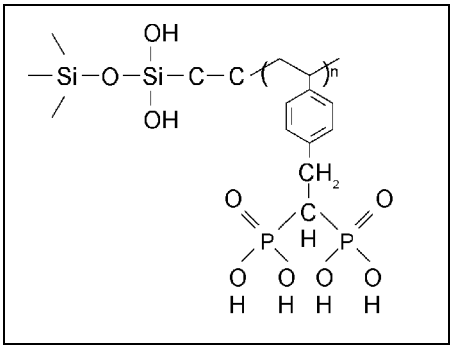
Problem:

A pressing challenge posed by waste of the DOE complex is radioactivity and the concomitant need for radiolytically stable treatment technologies. Radiation damage to polystyrene-based ion-exchange resins, caused by the rupture of the carbon-carbon bonds in the resin's crosslinkages, leads to resin degradation and loss of metal uptake capacity. This problem significantly limits the applicability of these resins for use by DOE in the clean-up effort.

A silica-based support, in contrast, consists of silicon and oxygen bonded together in a rigid, highly porous matrix. The silicon oxygen bonds are much stronger than carbon-carbon bonds and are much less susceptible to radiation damage and resin degradation. A silica-based resin could greatly aid DOE in the clean-up effort.

Solution:

A new silica- based resin, functionalized with diphosphonic acid ligands, can be used in a number of DOE activities involving the processing of low-level, transuranic, and high-level radioactive waste. This resin can also be used for processing liquid mixed waste, including mixed waste contaminated with organic compounds.



Benefits:

‣Increased radiolytic stability of the silica-based resin relative to its polystyrene-based counterpart

‣A resultant waste form that is amenable to disposal without additional treatment or that can be vitrified more easily than conventional ion-exchange resins

‣Better matrix stability at highly basic pH (pH above 11) than other silica ion exchangers

‣Performance improvements with waste streams containing organic compounds (>1%)

Technology:

Eichrom Industries will synthesize commercial quantities of a silica-based ion-exchange resin with the same or better metal-ion selectivity, metal uptake kinetics, and acid stability as the commercially available polystyrene-based Diphonix® ion-exchange resin. Diphonix® resin contains diphosphonic acid groups that function as chelating ligands and that exhibit significant selectivity for absorbing actinides and certain other classes of metals over the common elements sodium, calcium, and magnesium. Diphonix® resin retains its selectivity and metal uptake capacity even under highly acidic conditions because of the unique metal-ion coordination ability of the diphosphonic acid groups. In silica-based Diphonix® resin these groups

will be attached to the silica support, resulting in a resin with improved radiolytic stability while maintaining outstanding metal-ion selectivity and uptake.

Contacts:

Eichrom Industries, Inc. manufactures a variety of extraction chromatography, ion exchange, and solvent extraction products for cost-effective use in laboratory and industrial applications. For more information regarding this project, the contractor contact is:

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DOE's Morgantown Energy Technology Center supports the Environmental Management - Office of Science and Technology by contracting the research and development of new technologies for waste site characterization and cleanup. For information regarding this project, the DOE contact is:

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